



Reply To
Attn Of: HW-113

MEMORANDUM

Subject: Sediment Remedial Action Certification of Completion
St. Paul Waterway Problem Area
Commencement Bay - Nearshore/Tideflats Superfund Site

From: Philip G. Millam, Chief
Superfund Branch

Through: ~~for~~ Charles E. Findley, Director
Hazardous Waste Division

To: Dana A. Rasmussen
Regional Administrator

The purpose of this memo is to confirm the completion of the sediment remedial action in the St. Paul Waterway of the Commencement Bay - Nearshore/Tideflats (CB/NT) Superfund site. The sediment remedial action has been completed by Simpson Tacoma Kraft Company and Champion International, and is documented in the attached completion report prepared by the companies. The report has been reviewed by my staff to ensure that the remedial actions taken were consistent with the September 1989 Record of Decision (ROD) for the site.

The St. Paul Waterway is one of eight problem areas covered by the CB/NT ROD which require a combination of source control and sediment clean-up. The St. Paul Waterway is the first waterway in which source control and sediment remedial actions have been completed. The work was accomplished voluntarily by the two companies, with the assistance of the Washington Department Natural Resources, and is formally embodied in the September 27, 1990, Consent Decree executed by EPA.

Long-term monitoring of source controls and the sediment remedial action will be conducted to ensure the effectiveness and protectiveness of these actions. The actions taken to date are a significant precedent for similar actions that will be required in the CB/NT site.

The Washington Department of Ecology (Ecology) and the Environmental Protection Agency (EPA) share the lead agency role at the site. Ecology is the lead agency for source control. The source control completion report approved by EPA on September 28, 1990, describes the source control actions to taken to date,

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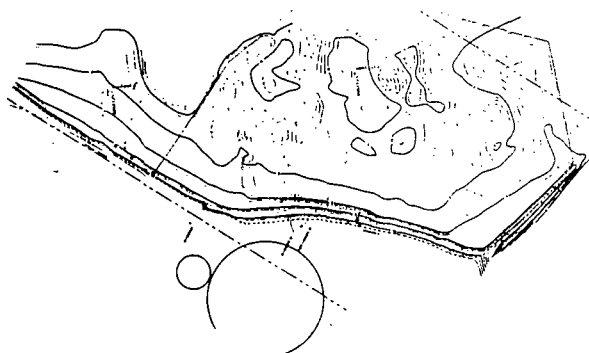
and future plans to monitor source control through the National Pollution Discharge Elimination System (NPDES) program. EPA will be the lead agency for sediment remedial action and will oversee the sediment remedy in accordance with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the federal Consent Decree (to be lodged after this certification is complete). The agencies will pursue other clean-up actions at the other problem areas in the CB/NT site in accordance with the ROD.

Approved: ✓ Disapproved: _____ Date: 1/30/91

Dana A. Rasmussen

Dana A. Rasmussen
Regional Administrator

**Commencement Bay Nearshore Tideflats
Superfund Completion Report for
St. Paul Waterway
Sediment Remedial Action**



Simpson

January 1991

Commencement Bay Nearshore Tideflats
Superfund Completion Report for
St. Paul Waterway
Sediment Remedial Action

By

Kenneth S. Weiner

submitted to the U.S. Environmental Protection Agency
for Simpson Tacoma Kraft Company and
Champion International Corporation

January 1991

The author gratefully acknowledges the assistance and advice of the following people in the preparation of this report: EPA Region X Superfund staff and legal counsel; Dave McEntee, Simpson Tacoma Kraft Co.; Ted Reeve and John Pulliam, Simpson; Jerry Ficklin, Ficklin Environmental Services; Don Weitkamp, Parametrix, Inc.; Mike Thorp, Heller Ehrman White & McAuliffe, attorney for Champion International Corporation; and Kathleen Barrett, Scott Waugh, and Jon McPhee, Preston Thorgrimson Shidler Gates & Ellis.

Kenneth S. Weiner

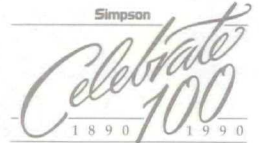
Preston Thorgrimson
Shidler Gates & Ellis
Attorney for Simpson
Tacoma Kraft Co.

December 1990



January 11, 1991

Ms. Lori Cohen
Superfund Site Manager
EPA Region X
1200 Sixth Avenue
Seattle, WA 98101



Dear Ms. Cohen:

It is my sincere pleasure to submit this Superfund Completion Report for the St. Paul Waterway Sediment Remedial Action in the Commencement Bay Nearshore Tideflats Superfund NPL site under paragraph 124 of the executed federal consent decree.

We understand that this is the first Superfund Completion Report in Commencement Bay and Puget Sound, and one of the first cleanups in the nation to reach this stage.

We are pleased that the federal EPA and state Department of Ecology have been able to work together with each other, with Simpson and Champion, and with the state Department of Natural Resources and other government agencies and Indian Tribes to achieve this cleanup. Advice and encouragement from interested citizens and environmental groups have been not only instrumental but have been an exciting part of this process.

It has been very important to us that the project was able to integrate pollution control and natural resource restoration because of Simpson's conviction that the Tacoma harbor and the Commencement Bay estuary can be a model of a healthy maritime economy and marine ecology.

I would also like to acknowledge the efforts of our project team, without whom this accomplishment would have remained a dream, including but certainly not limited to: my predecessor Jerry Ficklin, lead consultants Don Weitkamp and Greg Hartman, Simpson engineer Ron Larsen, Simpson Senior Counsel Ted Reeve and special environmental counsel Ken Weiner, and Jim Carraway, my counterpart at Champion, and his colleagues and legal staff.

We appreciate your guidance in the preparation of this report and your comments on the drafts submitted previously. As we discussed, we will update the bibliography to include relevant documents prior to the entry of the consent decree. Should you have any specific questions regarding the content of the report, please contact Ken Weiner at (206) 623-7580.

Sincerely,

Dave McEntee
Manager, Environmental Services and
St. Paul Waterway Project Coordinator

SUPERFUND COMPLETION REPORT

For St. Paul Waterway Sediment Remedial Action
Commencement Bay Nearshore Tideflats Superfund Site, Tacoma, Washington

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Attachment

SUPERFUND COMPLETION REPORT

**For Sediment Remedial Action at the
St. Paul Waterway Problem Area
Commencement Bay Nearshore Tideflats Superfund Site
Tacoma, Washington**

I. SUMMARY OF SITE CONDITIONS

A. Background: St. Paul Waterway Problem Area in the Commencement Bay Nearshore Tideflats Site

Introduction

Commencement Bay is the urban bay and harbor for the City of Tacoma. It is located between the mouth of the Puyallup River, which is a shoreline of statewide significance, and Puget Sound, which is an estuary of national significance (see Figure 1). The U.S. Environmental Protection Agency (EPA) initially placed Commencement Bay on the federal Superfund interim priority list in 1981 and formally designated it as the Commencement Bay Nearshore/Tideflats Site (Site or CB/NT Site) on the National Priority List in 1983. EPA has organized the Site into seven "Operable Units" and various "Problem Areas" within these units, as explained below.

This Completion Report for sediment remedial action describes the Superfund response actions and related environmental improvements that have been implemented for the St. Paul Waterway Problem Area, the area immediately to the south and west of the Puyallup River (see #6 on Figure 1). Superfund studies identified three potentially responsible parties at the St. Paul Waterway Problem Area: Simpson Tacoma Kraft Co. (Simpson), Champion International Corp. (Champion), and the Washington State Department of Natural Resources (DNR). Simpson proposed and performed the actions described in this report entirely with private funds from Simpson and Champion. As described below, federal, state, and local agencies, Indian Tribes, and interested citizens were involved in developing and overseeing the actions.

The response actions at the St. Paul Waterway Problem Area represent the first approved and completed sediment remedial action at the Site, as well as the first natural resource damage settlement for a waterway in Commencement Bay. In addition, the source controls being implemented for the St. Paul Waterway Problem Area represent the first approved and completed source control actions in the Commencement Bay Nearshore Tideflats.¹

¹ On September 28, 1990, EPA approved Ecology's Completion Report on the source control actions described in the CB/NT ROD for the St. Paul Waterway Problem Area.

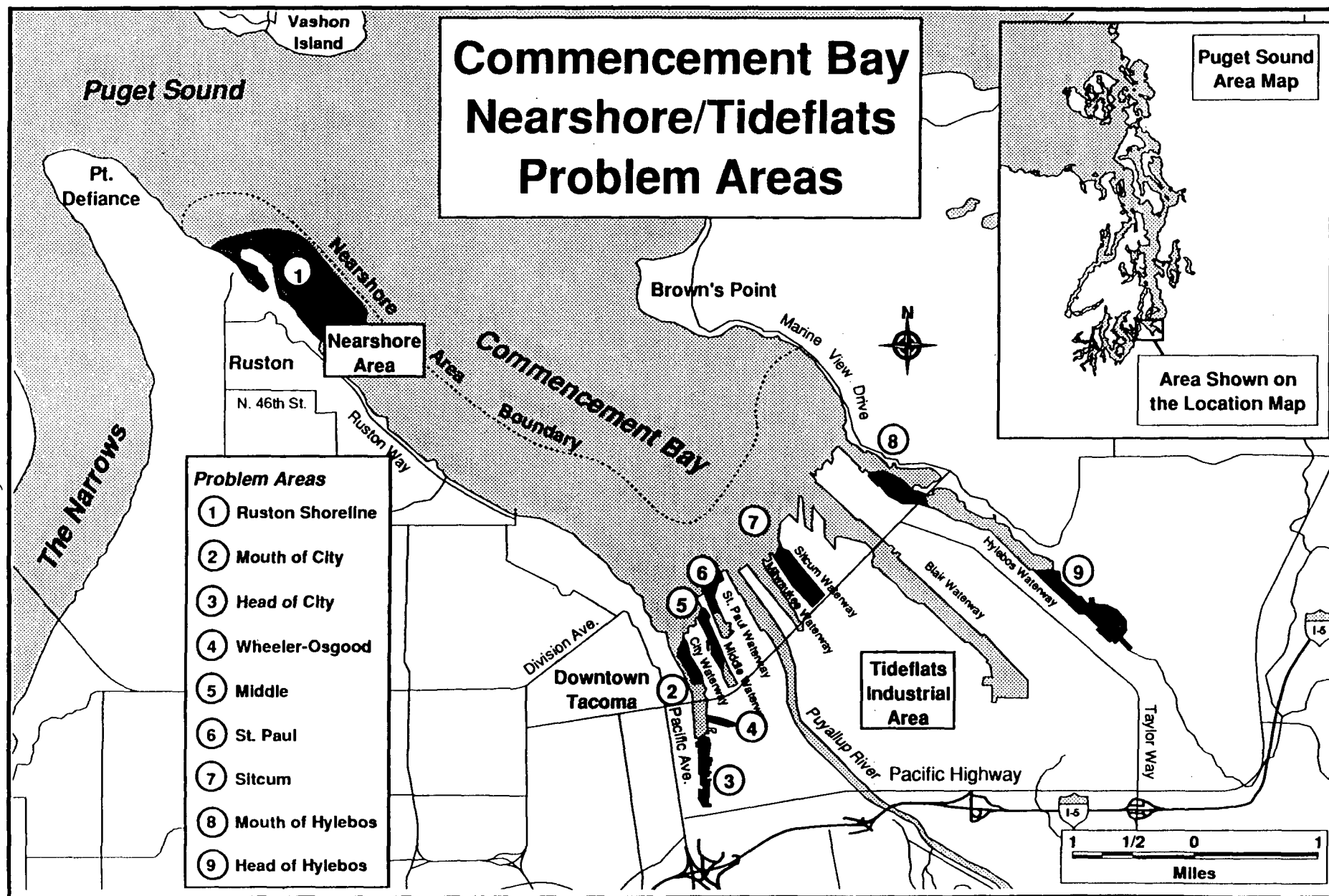


Figure 1. Commencement Bay Nearshore/Tideflats study area

Source: CB/NT Record of Decision (U.S. EPA, Sept. 1989)

The approval for the response actions takes the form of a federal consent decree (to which this Completion Report is appended), natural resource damage settlement agreement (appended to the federal consent decree), and a state consent decree. An overview and more detailed description of the regulatory approval process can be found in Parts II and IV below.

Overview of the Commencement Bay Nearshore Tidelands Superfund Site

The designation of a large portion of Commencement Bay as a Superfund site presents special challenges. The site includes contaminated marine sediments as well as highly industrialized upland areas. Unlike a typical landfill, where many people put material into a single facility, the CB/NT Site involves many parties who disposed of hazardous substances on separate pieces of property and into eight different waterways.

Although they have common elements, each waterway also has its own environmental conditions, sources of pollution, and potentially responsible parties. In addition, as EPA studies and its Record of Decision for the Commencement Bay Nearshore Tidelands (ROD or CB/NT-ROD) found, cleaning up mixtures of hazardous substances that have settled to the bottom of marine bays presents special difficulties. The difficulties are compounded because of the environmental sensitivity of disrupting fisheries and habitat during remedial actions. For example, federal, state, and local agencies and Indian Tribes prohibit all work in these waters at least six months each year to protect migrating salmon.

Recognizing the complexity of addressing the cleanup of the Commencement Bay environment, EPA organized the Site into manageable parts. There are currently seven of these "Operable Units": (1) CB/NT Sediments; (2) Asarco Tacoma Smelter; (3) Tacoma Tar Pits; (4) Asarco Off-Property; (5) CB/NT Sources; (6) Asarco Sediments; and (7) Asarco Demolition. Under a cooperative agreement, Ecology is the lead agency for source control (operable unit 05), and EPA is the lead agency for the others.

The CB/NT sediments (Operable Unit 01) have been in turn been divided into eight "problem areas" in part because they are contaminated by different sources in different waterways. This allows the remedy to be designed and implemented to address the contaminants of concern and to fit the specific environment of each waterway. (After the ROD was issued, EPA redesignated the ninth problem area, identified on Figure 1 as the Ruston Shoreline, as Operable Unit 06 - Asarco Sediments.) The St. Paul Waterway Problem Area is one of the eight problems areas in the CB/NT ROD which required sediment remedial action. The overall CB/NT process and cleanup strategy is described below in Section IV.A.

Overview of Agencies Involved

There are several other government bodies that assert jurisdiction over the cleanup and restoration of the contaminated areas in Commencement Bay. Most of these governmental entities have memoranda of agreement (MOAs) relating to their working relationships under these laws. The project described in this report has the formal approval or concurrence of all of these agencies:

- Both the federal and state governments have "Superfund" laws that apply to the site. The federal law is administered by EPA, while the state law is administered by the Department of Ecology (Ecology). Federal Superfund is the Comprehensive Environmental Response, Compensation and Liability Act or CERCLA; the Washington law is the Model Toxics Control Act or MTCA.

- The Puyallup Tribe of Indians (Puyallup Tribe), a sovereign nation which recently settled its land claims with the United States, State of Washington, local governments in Pierce County, and other parties, has treaty rights relating to fishery resources and habitat.
- Much of the aquatic land where sediments have been contaminated is owned by the State of Washington, which manages the land through the state Department of Natural Resources (DNR). DNR has independent management and enforcement authority through its leases with the users of these aquatic lands.
- Federal and state hazardous waste cleanup and water quality laws also provide for restoration of or compensation for damages to natural resources, which involves federal, tribal, and state agencies with responsibilities for natural resource, wildlife, and fisheries. The National Oceanic and Atmospheric Administration (NOAA) in the Department of Commerce is the lead federal natural resource trustee, and Ecology is the lead state trustee. the Puyallup Tribe and Muckleshoot Tribe are also trustees.
- Other permitting agencies such as the U.S. Army Corps of Engineers (Corps of Engineers) or the City of Tacoma (City) may be involved if cleanup or restoration actions require permits for dredging, filling or other work in the Bay or along its shorelines.

Key references for this report are found at the conclusion of each Part and in the attached bibliography.

B. Summary of Environmental Conditions and History of the St. Paul Waterway Problem Area

Environmental Conditions

The St. Paul Waterway Problem Area is located between the Puyallup River to the north and the Middle Waterway to the south (Figure 1). A rubble mound jetty was constructed on the west bank of the Puyallup River mouth in the 1930s by the Corps of Engineers as part of the Tacoma Harbor Project. The jetty separates the Puyallup River from the St. Paul Waterway, creating a shallow and calm area of Commencement Bay which ranges in depth from about 20 feet to a sandbar that is exposed at low tide. Natural forces are gradually building up this area by depositing sediment from the Puyallup River. As will be described below, the key areas of sediment contamination were located in this shallow subtidal area. Prior to the remedial action, the St. Paul Waterway Problem Area was subtidal.

The St. Paul Waterway itself is about 2,000 feet long, about 500 feet wide, and from about 10 to 30 feet deep. The Waterway was created in stages, beginning in the 1920s. The Waterway area is not used or needed for navigation, other than its historical and current use for log rafts, chip barges, and similar small craft. A 57-acre peninsula of filled tidelands lies between the mouths of the Puyallup River and the St. Paul Waterway. This area was originally an intertidal mudflat between two forks of the mouth of the Puyallup River. The original 1,750 acres of productive mudflat throughout Commencement Bay has been reduced to less than 100 acres in the past century.

Ownership and Industrial Use

The filled uplands and the adjacent tidelands have been used for pulp and paper and related forest products operations since 1927. The Tacoma Kraft Mill (mill), a pulp and paper facility, is located there. Five years ago, Champion acquired the mill as a result of a merger with the St. Regis Corporation. Several months later in August 1985, Simpson acquired the mill from Champion and is the current owner and operator. Although the St. Paul Waterway itself has been privately owned by the mill owners, Simpson and previous owners leased the tidelands in Commencement Bay adjacent to the Waterway and mill from DNR, as well as leasing some uplands between the inner and outer harbor lines. DNR manages the leased lands for the State of Washington.

C. Summary of Sediment Contamination

From 1983-85, EPA and Ecology prepared a study on the nature and sources of contamination in the Bay (the Commencement Bay Nearshore Tideflats Remedial Investigation or CB/NT RI). This study identified the St. Paul Waterway Problem Area as a 17-acre area of contaminated marine sediments adjacent to the mill. Simpson and Champion (the Companies) then began detailed studies to review, confirm, and further characterize the St. Paul Waterway Problem Area, in consultation with the agencies, Puyallup Tribe, and the public as described further below.

The problems basically stemmed from two sources (see Figure 2):

- *Wastewater* from the plant, which was untreated until the 1960s. This led to contaminated sediments near the mill's outfall. The Superfund studies discovered that several of the key chemicals came from shipments of contaminated products and materials to the plant from other companies and not from the pulp and paper process. One result of the remedial investigation was that immediate source control actions were taken by Simpson, including discontinuing the purchase of contaminated raw materials. These efforts succeeded in eliminating more than *one million* pounds of potential chemical pollutants on an annual basis. Simpson will continue to perform extensive monitoring under the NPDES program, as noted in Ecology's source control completion report.
- *Loss and runoff of woody debris* from log and wood chip operations and from stormwater runoff from process areas of the mill.

The sediments of Commencement Bay next to the mill became contaminated with chemicals and organic debris. In the area near the outfall, chemicals toxic to marine life, such as phenolics, cresols and cymenes, settled into the sediments on the bottom of the Bay. In the same area, and extending into the Waterway, accumulations of logs, wood chips, sawdust, and similar organic debris blanketed the bottom and mixed with the sediments. The data showed three fairly distinct areas of contamination, with lower levels of concern as the distance from the former outfall increased (see Figure 3). Area A, closest to the former mill outfall, had the most chemical contamination and less organic woody material. Area B was a mixture of chemical and organic woody material. Area C was largely woodchips on top of the natural sediments.

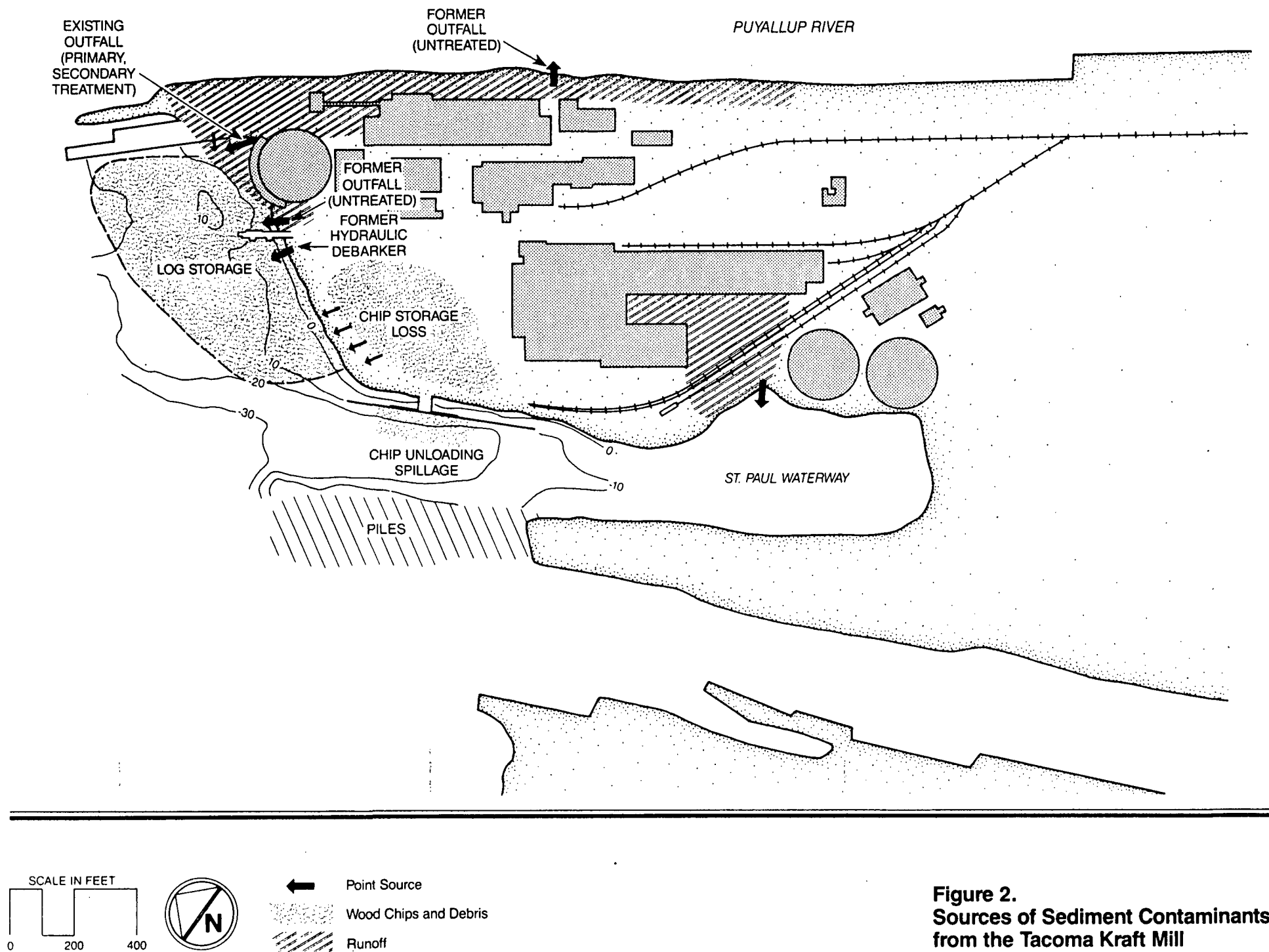


Figure 2.
Sources of Sediment Contaminants
from the Tacoma Kraft Mill

Wastewater and Outfall

The RI identified, and the Companies' studies confirmed, that the following chemical compounds were found in the sediments adjacent to the mill: p-cresol (4-methylphenol), p-cymene (1-methyl-2-methylethyl benzene), guaiacol (2-methoxyphenol), phenol, naphthalene, low molecular weight polyaromatic hydrocarbons (LPAHs). Of these compounds, p-cresol, guaiacol and phenol were found at concentrations exceeding the apparent effects thresholds (AET) in a number of sediment samples taken in the immediate vicinity of the old outfall. Also, p-cymene – for which an AET has not been established – was found at high concentrations (5,500-273,000 ppb) in many of the same samples. Naphthalene and LPAHs exceeded AETs in laboratory tests with small shrimp-like organisms called amphipods in samples collected adjacent to the mill outfall. This chemical sampling provided the basis for evaluating feasible remedial technologies, for determining indicator chemicals for the monitoring and contingency plan, and for establishing performance standards for the remedy. Apparent effects thresholds or AETs were developed for Puget Sound sediment criteria and represent the highest concentration of an individual chemical contaminant shown *not* to have adverse biological effects, based on tests using sensitive marine organisms such as amphipods, oyster larvae, and so on (see footnotes 5 and 6).

As noted above, the contaminant concentrations of concern and the number of contaminants exceeding amphipod AETs dropped rapidly with distance from the outfall (see data in Appendix IV - Sediment Quality of the Project Analysis cited in footnote 3 below). The shallow sandbar (-2 to +2 ft MLLW) at the edge of the Puyallup River delta near the end of the mill's former pier formed a boundary to chemical contaminants on the north side of the area. Contaminant concentrations of concern extended parallel to the shoreline for about 600 feet. This data enabled a margin of safety to be included in the geographic boundary used for the sediment remedial action (see dotted line on Figure 3).

There were three different but related aspects to the sources of contamination, which are described in more detail in the source control completion report. First, the mill's wastewater was discharged without treatment for 37 years. In the 1960s, the mill began primary treatment of its wastewater. Secondary treatment commenced in the mid-1970s.

Second, the problem chemicals identified in the sediments were not those typically associated with paper mills or the pulping process. The Superfund studies, coupled with detailed analysis for the mill's source control efforts, found that raw materials supplied to the mill were contaminated with chemicals of which the mill was previously unaware and which were unnecessary to the pulping process.

Third, the mill's outfall (the pipe that releases the treated water, or effluent, into the Bay) was located on the bank of the shoreline in the shallow area to the west of the mill, between the River and the St. Paul Waterway. Depending on the tide, the outfall was within 0-12 feet of the water's surface. When up to 30 million gallons a day of warm wastewater coming out of the outfall first mixed with the Bay's saltwater, the initial dilution was in the range of 2:1 to 5:1 (ratio of seawater to effluent). This low level of initial dilution allowed a process to occur called "flocculation," where dissolved material and smaller particles combined into larger particles. These larger particles were heavier and sank onto the sediments on the bottom of the Bay near the outfall.

Simpson implemented source control actions simultaneously with the sediment remedial action to address each of these problems and prevent future recontamination of the site from mill operations. Although these source control actions are not governed by the federal and state consent decrees

on the sediment remedial action, they were an integral part of the project planning and implementation. They are described in this section and in Parts II and III below to help the reader understand the relationship between the sediment response actions and the overall St. Paul Waterway Area Remedial Action and Habitat Restoration project.

The discharge of secondary-treated effluent from the new outfall was designed to prevent flocculation (it regularly achieves a dilution ratio of more than 70:1 in marine water) and to trap in the layer of water that moves away from the shoreline, where the most sensitive biological areas are located in the Commencement Bay estuary. Other major source control actions noted in the source control completion report include installation of a new bleach plant, pulp washing line, and chlorine substitution processes; purchasing of makeup chemicals and improvement of operating practices; containment and control of woodchips and stormwater.

In order to confirm the assumptions and performance of the predictive models and tests used by Simpson to plan and implement its source control actions, the final NPDES permit will include the following: (1) calculation of the actual dilution of effluent; (2) sampling of particulates in the effluent to determine the presence of problem chemicals; (3) influent and effluent sampling of internal waste streams; (4) sediment sampling in the vicinity of the outfall; and (5) acute and chronic toxicity testing of the effluent. In addition to these studies, the NPDES permit contains a reopener such that permit modifications could occur if studies show that the source control measures are not protective of sediment quality.

Other long term Ecology actions taken to confirm protectiveness and assess adequacy include: (1) permittee submittal of monthly discharge monitoring reports which include the results of continuous monitoring of pH, flow and temperature; daily test data for dioxin, AOX, biological oxygen demand and total suspended solids; and weekly test results for soluble copper; and (2) regular NPDES permit inspections to verify permittee compliance with self-monitoring requirements and compliance schedules. The different types of NPDES inspections that Ecology conducts include: compliance evaluation, compliance sampling, toxics sampling, compliance biomonitoring, and reconnaissance inspection. The methods and procedures for conducting each inspection type is contained in the EPA NPDES Compliance Inspection Manual.

Woody Material and Runoff

The shallow area to the west of the mill, between the Puyallup River and the St. Paul Waterway, had been used as a log pond from the late 1800s through the early 1970s. Logs were stored, sorted, and debarked there. Stormwater also carried woody debris into the Bay. Until 1977, fine organic debris and suspended solids were discharged in primary effluent from the old outfall.

Wood chips also sank to the bottom of the St. Paul Waterway during the importing, unloading and storing of wood chips for mill operations. Additional organic material came to the water of the Bay from the mill site through surface runoff or the action of the wind.

The extent of contamination by organic debris was found to be more pervasive than chemical contamination as measured by total volatile solids (TVS) concentrations of the sediments. Sampling data showed TVS concentrations of 30% in a band adjacent to the shore and outfall area, followed by a narrow band of 20% concentration and a wider band of 10% concentration. Estuarine sediments commonly have TVS concentrations of 5-10% and greater. The amphipod AET calculated for TVS is 27% (an amphipod is a small shrimp-like marine organism). To provide a greater degree of cleanup and restoration, organic concentrations exceeding 20% were

PUYALLUP RIVER

EXISTING
OUTFALL

A

B

C

ELEVATIONS IN FEET MLLW

SCALE IN FEET



- Remedial Action Boundary
- Chemical Contaminants
- /// Organic Debris Contamination (+ 20%)

Figure 3.
General Areas of Concern

considered by the Companies to be concentrations of concern and were included in the sediment remedial action (see Figure 3).

Marine Biology

The sediment conditions in the St. Paul Waterway Problem Area were adverse to most of the biota commonly found in shallow water portions of Puget Sound. Near the outfall, the RI concluded from lab tests that the conditions were among the most biologically stressed in the nearshore tideflats. The woody organic debris did not pollute in the same way as chemicals, but the decomposition of this organic material required so much oxygen that there was little or no oxygen available to support normal marine life. The natural biological populations in this area of the Bay were severely depressed by contamination from both chemical and organic debris.

Key references for Part I: *Project Analysis for the St. Paul Waterway Area Remedial Action and Habitat Restoration Project* and references cited in the Project Analysis (see footnote 3 below), CB/NT RI, FS, and ROD, Ecology Source Control Completion Report for the St. Paul Waterway Problem Area, and project documents and supporting analyses listed in Part B of the attached bibliography.

II. REMEDIAL PLANNING ACTIVITIES

A. Overview of the Process

The remedial planning activities summarized in this completion report is somewhat more complicated than may be typical, both because of the complexity of the Commencement Bay site and because federal and state approvals were involved. In addition, the sediment remedial action planning was part of an integrated environmental improvement project which included habitat restoration and source control. The following two paragraphs provide a brief overview of the state and federal processes, which are explained further in this Part and in Part IV below.

In acquiring the mill in 1985, Simpson assumed responsibilities and a requirement to design and construct an improved outfall. Cognizant of the ongoing Commencement Bay Superfund studies and encouraged by Ecology to examine source control, sediment remedial action and habitat restoration alternatives, Simpson and Champion planned a more comprehensive approach with agencies, citizens, and the Puyallup Tribe during 1986-87. Simpson implemented an aggressive source control program under state supervision, leading to Ecology's submittal in September 1990 of the first Source Control Completion Report in the Commencement Bay Nearshore/Tideflats Site. The program included extensive capital facilities and process changes to control chlorinated organics, dioxins, copper, and other chemicals; stormwater collection and treatment; and a different outfall design than was initially planned.

Plans for addressing sediment contamination and restoring and enhancing the nearshore habitat evolved at the same time. Although the sediment remedial action was initially planned as a joint federal-state Superfund action, this was not possible. The Companies therefore proceeded under a state consent decree, along with numerous other permits and approvals obtained during the last six months of 1987. Construction was completed by September 1988, and the ongoing monitoring

program commenced. EPA issued the CB/NT ROD in September 1989. After consulting with the natural resource trustees, EPA and the trustees began negotiations with the Companies and DNR in May 1990, which led to the federal consent decree, revised monitoring plan, natural resource damage settlement, and amended state consent decree. This first completed remedial action in Puget Sound has been privately-funded; no public funds were used for the project.

B. Agency and Public Consultation and Development of a Comprehensive Approach

Upon acquiring the mill in 1985, Simpson assumed an NPDES permit and an administrative order issued by Ecology which required the construction of a new outfall. Encouraged by Ecology to address several environmental problems at the same time, Simpson began in 1986 to investigate and implement better control of sources of pollution at the mill and, with Champion, to plan remedial action for the contaminated sediments. A number of studies were conducted by Parametrix, Inc. to characterize the nature and extent of the contaminants in the St. Paul Waterway Problem Area. These are included in the *Project Analysis for the St. Paul Waterway Area Remedial Action and Habitat Restoration Project* (see footnote 3 below).

Remedial action planning for the St. Paul Waterway Problem Area proceeded in parallel with the RI/FS process for the Commencement Bay Nearshore/Tideflats Site, as discussed below and in a detailed chronology included in the attached bibliography.

Before proposing any actions, Simpson and Champion consulted with the Puyallup Tribe, environmental groups and interested citizens, federal, state, and local officials and agency staff beginning in January 1987. In addition to meetings with Ecology and EPA staff, Simpson and Champion had coordination meetings with TetraTech, the agencies' consultants on the CB/NT studies, to ensure that the remedial action planning for the St. Paul Waterway Problem Area was consistent with the overall CB/NT FS process and apparent effects threshold (AET) methods and values. Because the CB/NT FS was scheduled to be completed in the summer of 1987, the original plan was for simultaneous federal and state approval. The CB/NT FS fell behind schedule, and the Companies' project initially proceeded under a state consent decree.

A comprehensive environmental cleanup and restoration approach took shape which addressed cross-media environmental issues. "Cross-media" refers to the situation where issues involving one part of the environment, such as land or air, affect another part, such as water. The approach included:

- a new outfall for the secondary treatment plant.
- permanent isolation of the contaminated sediments from marine life by capping the area with clean sediments from the nearby Puyallup River.
- habitat restoration and enhancement of nearshore and intertidal areas.
- preventive measures against future sediment contamination from the mill, including source control within the mill, monitoring and contingency plans.

Several corollary objectives emerged from these discussions that shaped the remedial action planning and consistency with applicable, relevant and appropriate legal requirements. Some of these requirements were the City's shoreline management master program (the applicable Coastal Zone Management Plan), DNR's constitutional and statutory aquatic lands management mandates, the Puget Sound Management Plan adopted by the Puget Sound Water Quality Authority, and the

Clean Water Act's Section 404(b)(1) guidelines administered by the Corps, EPA, and other agencies. These corollary objectives for this particular problem area included:

- minimizing dredging of contaminated sediments.
- preserving existing water dependent and harbor uses.
- using reliable and appropriate technology.
- designing the project to complement the natural forces at work in Commencement Bay.

Meetings with the public and agencies also identified additional information that they would need to evaluate the alternatives. This information included, for example:

- additional research into the availability of bioremediation, solidification and other innovative technologies used here and abroad.
- analytical modeling to determine whether toxic concentrations would migrate upward through the cap and the performance of alternative capping technologies.
- extensive sampling and sediment quality analysis of the Puyallup River sediments to ensure that they would provide a suitable new habitat.
- development of physical, chemical, and biological monitoring plans – before, during and after construction – to minimize environmental impacts and assure the effectiveness of the remedy.
- preparation of remedial design and action (RD/RA) plans to enable detailed public review and to support agency permitting and other decisions.²

Project planning integrated sediment remedial action and habitat restoration. While the bottom portion of the cap would be used to isolate contamination, the upper portion was designed to provide a suitable base for new marine life. In addition, the existing conditions over nearly all of the 17-acre area were subtidal. The project was designed to enhance the restoration by creating intertidal habitat over approximately a third of the area, including more than 1,400 feet of new intertidal beach. Intertidal areas provide important biological functions. Juvenile chum and chinook salmon commonly reside in these areas during their first few weeks of life in the estuary. Shorelines, juvenile marine fish, and a wide variety of invertebrates also depend on the intertidal mudflat habitat. As noted in Section I.B, Commencement Bay has lost most of its intertidal habitat over the past century of urban development.

²Although CERCLA provides that on-site remedial actions are exempt from having to obtain conventional permits, the Companies decided to obtain permits for four main reasons. As the project was likely to be the first remedial action in Puget Sound, the Companies believed there would be considerable potential for public misunderstanding if the project were to proceed without permits, regardless of whether hazardous waste laws exempted the project from permitting. Applying for permits would also allow the project to proceed under state law if EPA was not in a position to enter a federal consent decree. Another consideration was that an efficient way to demonstrate compliance with applicable, relevant and appropriate requirements (ARARs) was to have permits from the agencies which administer those laws. Given the limited period when work is allowed in the marine waters of Puget Sound or in the Puyallup River, it was critical to be ready to start the remedial work as soon as a consent decree was approved. In addition to the regulatory uncertainty about whether the project would be approved by EPA, Ecology or both, the State of Washington was also in the midst of a debate over a state Superfund initiative. One of the issues was the need for environmental impact analysis and permitting for cleanup actions. By conducting analyses under the National Environmental Policy Act (NEPA) and State Environmental Policy Act (SEPA) and by obtaining permits, the project would be consistent with whichever version of the state hazardous waste cleanup law was ultimately enacted.

The habitat enhancement involved two basic actions: (1) raising the elevation of the Bay bottom above a subtidal area; and (2) providing substrate of more natural characteristics. These characteristics included using clean, native sediments of coarse sand and silt from the adjacent Puyallup River bed, constructing varied topography allowing pools as well as ridges, and scattering large cobbles and small boulders to provide a substrate for many forms of algae. The rocks, together with the biota they support, were designed to increase the diversity of organisms inhabiting the site and to increase both the cover and feeding opportunities for juvenile fish. The plan was based on the premise that, given the high productivity of this Puget Sound estuary, marine life would rapidly reestablish itself under natural physical conditions. The plan was also designed to limit human intervention and "over-engineering" of the restoration and enhancement effort.

The Project Analysis for the St. Paul Waterway Area Remedial Action and Habitat Restoration Project (Project Analysis) was circulated to agencies and the public in July 1987, in conjunction with filing applications for federal, state, and local permits and approvals (the approvals obtained in this section did not include federal Superfund approval, which is described below in Part IV). The relevant information needed to review the proposed project under the various applicable laws was combined in a single document to assist public and interagency review.³ The Project Analysis explained the remedial design, planning, and decisionmaking process in detail (Appendix IX). It also contained a plain English explanation of the key laws and the public notice and comment period under all applicable laws (Overview and Appendix IX). Prior to the formal review process, public participation was sought through meetings with environmental organizations, union representatives, and public service groups.

The formal public and agency review process prior to commencing remedial construction activities is summarized in this paragraph and described in more detail in the attached bibliography and chronology. Joint public notices, meetings, and hearings were held, except for the Corps of Engineers' permit process which ran concurrently. Extensive public notice was given through the Project Analysis, mailings to interested groups and individuals, display ads, and legal notices. A public information meeting was held on August 11, 1987 followed by comment periods in compliance with SEPA, Shoreline, and Corps of Engineers' permit requirements. In addition, copies of the Project Analysis and other relevant documents were made available at 22 locations from the beginning of the comment period. Public and agency comments were received, and no opposition to the project from the public was expressed. On September 22, 1987, a public hearing was held before the Tacoma Hearing Examiner, which was advertised and convened as a joint hearing to meet the requirements other laws as well.

Even though Ecology was acting as lead agency under state law, the documents, notices and opportunity to comment were provided and, although not requested by EPA, a verbatim transcript was made and transcribed consistent with the public participation provisions of Section 117 of CERCLA. As stated above and in the federal consent decree, this approach was taken to ensure that the project was designed to be consistent with all federal, state, and local laws.

³The Project Analysis described, referenced, and incorporated the relevant studies and consisted of a Project Overview, SEPA Environmental Checklist and related environmental assessment, ten technical appendices including a Focused Feasibility Study for the St. Paul Waterway Area (Appendix VI). It was supplemented by Supplemental Information Packets (September and December 1987).

The City of Tacoma Hearing Examiner found and concluded that the proposed remedial action would have the least adverse environmental impacts and the most environmental benefits among the alternatives studied, was the preferred alternative at the problem area location from the standpoint of consistency with shoreline policies and requirements, was in the public interest, and appeared to be the only alternative that could be implemented in the very near future at the site.

Simpson, Champion, DNR, and Ecology began negotiating a state consent decree for the sediment and habitat restoration components. Informal consultation with the public continued during this time, including review of a draft of the proposed decree. A proposed decree was filed with state court on November 6, 1987, for a 30-day public and agency comment period.

C. Agency Approvals

As part of the interagency review process, several agencies requested the development of a more detailed monitoring plan and a contingency plan in the event the project did not perform as planned. Representatives from EPA, Ecology, the Corps of Engineers, the Puyallup and Muckleshoot Tribes, federal and state fisheries and natural resource agencies, and the Companies met for approximately three months and developed the Monitoring and Contingency Plan. Despite some reservations by a few agencies, this plan became Exhibit D to the state consent decree and was made a condition of the Corps of Engineers, hydraulics, and shoreline permits, Ecology's water quality certification, and DNR's lease (see list of agency approvals below).

Over a five-and-a-half month period, the following permits and approvals were granted for the RD/RA phase of the work:⁴

- EPA Letter of Concurrence on the 404/Section X permit to the Corps of Engineers (September 11, 1987).
- Shoreline Management Substantial Development Permit and Shoreline Conditional Use Permits (City of Tacoma File No. 141.422) (October 13, 1987); Shoreline Conditional Use Permit #590-14-7278 approved by Ecology (October 20, 1987).
- NPDES Permit Extension for Outfall (Ecology Order No. DE 87-307)(November 9, 1987), amending Condition S3 of NPDES Permit WA-000085-0.
- Ecology Coastal Zone Management Certification and State of Washington Concurrence to the Corps of Engineers (November 18, 1987).
- Ecology Water Quality Certification (November 18, 1987).

⁴It should be noted by way of clarification that some of these approvals address different components of the work. The approvals under the 1987 state consent decree and the 1990 federal consent decree, which will be described below, address the sediment and habitat restoration actions. Other components, such as source control, continue to be governed by other laws and permits, such as the Clean Water Act.

- Hydraulic Project Approval (Department of Fisheries No. B2-11576-03, November 17, 1987) and exchange of correspondence regarding interpretation of conditions (November 25 and December 18, 1987).
- Corps of Engineers 404/Section X Permit No. 071-OYB-2-011576 (December 15, 1987).
- Corps of Engineers Permit Evaluation and Decision Document, including NEPA Environmental Assessment and Finding of No Significant Impact and Section 404(b)(1) Evaluation of Alternatives (December 16, 1987).
- Ecology Letter of Approval for the Dredge and Disposal Plan (December 16, 1987).
- DNR Harbor Area Lease No. 22-002658 (December 21, 1987); Material Removal Agreement No. 31-049168 (December 21, 1987); and Material Deposition Agreement No. 20-012631 (December 21, 1987).
- Consent Decree (state consent decree) among Simpson, Champion, the DNR and Ecology entered by the Superior Court for the State of Washington for Pierce County, File No. 87-2-07673-9 (December 24, 1987).

D. Community Review and Acceptance

Environmental organizations, citizens concerned about Commencement Bay, and other interested members of the public were involved in the remedial action planning from the outset. The chronology in the bibliography indicates regular informal and formal consultation with many groups and individuals, including the Audubon Society, Sierra Club, Washington Environmental Council, League of Women Voters, The Mountaineers, Greenpeace, Friends of the Earth, and the Puget Sound Alliance.

The public was involved at each step described above, including review of preliminary draft documents such as the environmental analyses, monitoring plan and consent decree.

The degree of community support for the action was reflected by the following items, which are in the attached bibliography:

- 22 Tacoma-Pierce County labor, environmental, business, citizen leaders and elected officials sent a letter to EPA and other agencies urging approval of the project.
- The Washington Environmental Council comment letter on the proposed state consent decree stated: "We hope other plans will be as good as this one."
- At the public hearing, a Sierra Club member testified: "We see it as a model of how industry can involve environmental groups early in the process."
- Nominated by the Tahoma Audubon Society, Simpson received from Governor Gardner the 1988 Washington State Environmental Excellence Award (Industrial Category) by the Washington State citizen's Ecological Commission as an

"outstanding voluntary environmental program or activity that exceed regulatory permit or license requirements."

E. Summary of Actions Implemented

Pre-construction monitoring, construction activities, and associated monitoring began immediately and were completed in September 1988, as further described below in Part III on Remedial Construction Activities.

The alternative that was implemented under these approvals is summarized by the following statement from the Project Analysis:

Recognizing that a better outfall, better control of sources of pollution at the mill, and remedial action for the contaminated sediments were all related, Simpson began planning a series of actions to address these "cross-media" environmental concerns . . . The proposed project will correct the problem of sediment contamination on the bottom of the Bay near the mill by permanently capping this relatively shallow area with clean Puyallup River sediments; installing a new secondary treatment plant outfall; collecting and providing secondary treatment for stormwater; containing chip spillage; and creating substantial new intertidal habitat for bird and marine life, thus enhancing Commencement Bay and Puyallup River aquatic resources. The proposed project will preserve existing water-dependent harbor and maritime uses of the site

Key references for Part II: Project Analysis, Fact Sheet, permits and approvals in Part A of the bibliography, public notices and fact sheets in Part C of the bibliography, public hearing transcripts, exhibits and comment letters in Part D of the bibliography, principal agency correspondence and general index of responses to agency comment letters in Parts E and F of the bibliography, sampling of press clippings and articles on the project in Part G of the bibliography, and summary of project chronology in Part H of the bibliography.

III. REMEDIAL CONSTRUCTION ACTIVITIES

A. Overview of Tasks Performed Including Monitoring and Reporting

Construction of the sediment remedial action and related activities such as the outfall, source control, and habitat restoration actions, consisted of nine tasks: dredging for the outfall alignment; placement of outfall dredged material; removal of the former outfall; site preparation; chip barge dredging and placement of dredged material with temporary cap; construction of the initial part of the cap (sometimes referred to as a "berm," although it was not actually a berm but was the first lift of the cap, strategically placed to prevent a mud wave of contaminated sediments); placement of the sediment cap; fill over the existing outfall area; and habitat enhancement capping (see Figure 4 and Exhibit B of state consent decree).

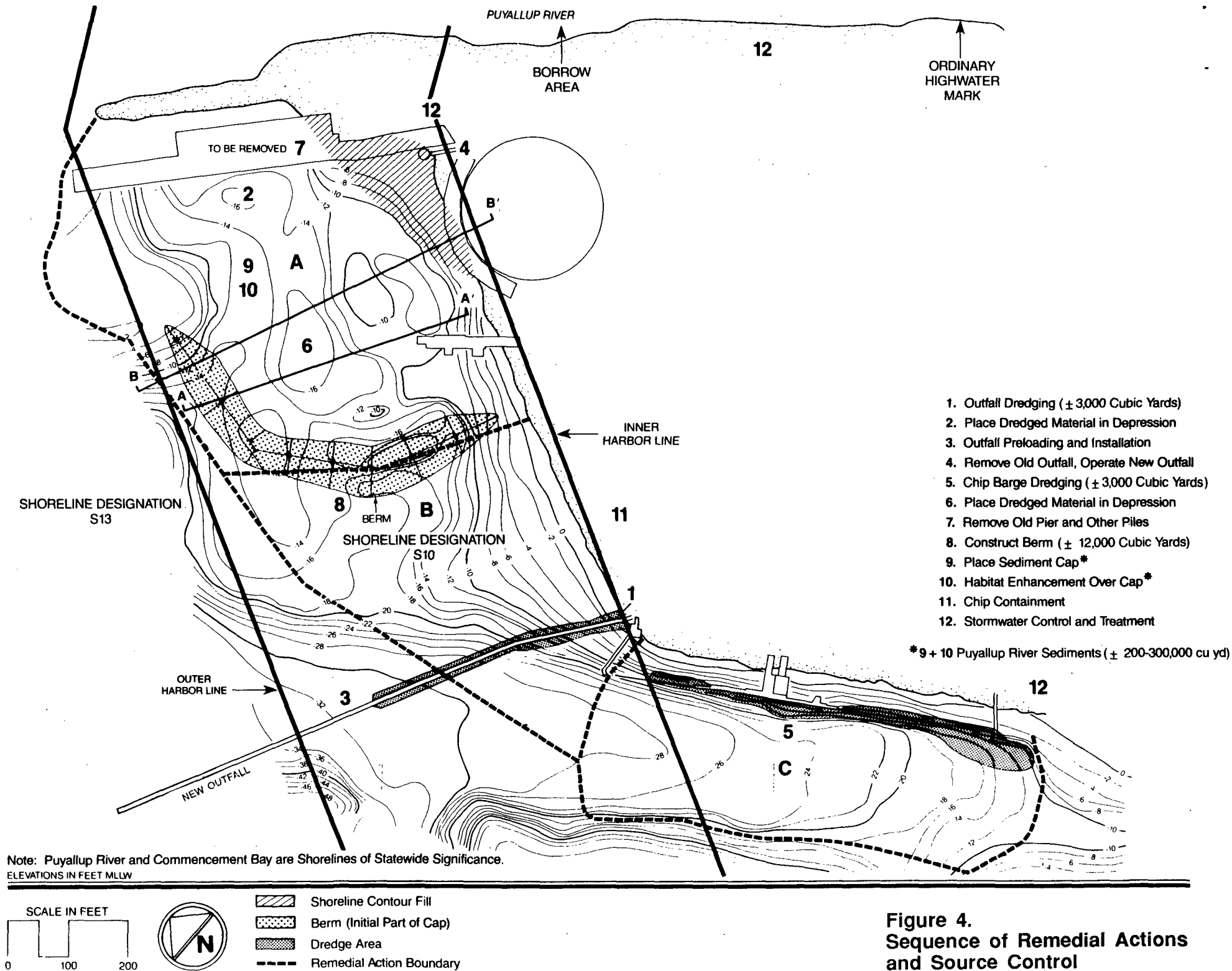


Figure 4.
Sequence of Remedial Actions
and Source Control

Construction monitoring was designed to assure compliance with the project design by determining the quantity and location of all material dredged and deposited, to assure compliance with water quality certification and to determine final cap thickness and bed topography (see Project Analysis, Appendix VIII, for monitoring methods and equipment, as supplemented by the Monitoring and Contingency Plan, which was made a part of the state consent decree and construction permits, and the Dredging Plan, which was made a part of the water quality certification, hydraulic project approval, and DNR agreements).

Monitoring and construction activities were required to be reported monthly to Ecology and specified agencies with jurisdiction and available to consulted agencies identified in the Monitoring and Contingency Plan, including EPA, NOAA, Puyallup Tribe and Muckleshoot Tribe. Key progress reports were also sent to public interest groups and other interested citizens. Nine monthly progress reports were submitted to Ecology by Simpson from commencement of construction to completion (January - September, 1987).

During construction, Simpson's Project Manager was Jerry Ficklin, Environmental Services Manager of the mill at that time. Simpson engineer Ronald S. Larsen assisted Mr. Ficklin as Project Supervisor. Parametrix, Inc. and Ogden Beeman & Associates, Inc. served as the principal consultants for remedial design planning and construction oversight. Parametrix, Inc. served as the monitoring contractor, and Analytical Resources Incorporated performed the laboratory analysis. General Construction Company and A. H. Powers of Seattle, Washington, and Nehalem River Dredging Company of Nehalem, Oregon, served as principal dredging and bathymetry contractors.

The Puyallup Tribe, under contract with Simpson, had representatives observing and coordinating dredging work in the Puyallup River. Ecology, in consultation with other agencies, inspected the construction work for each task on an ongoing basis for compliance with remedial design specifications, issuing letters of acceptance and approval as appropriate. The bibliography contains a more detailed listing of personnel and firms involved with the project.

B. Outfall Relocation and Site Preparation

The outfall needed to be relocated before the sediment and habitat restoration components. The outfall's permitted 30 mgd discharge of secondary effluent into a calm and shallow area did not allow both dredging of contaminated sediments as well as the placement of clean, native Puyallup River sediments without dispersing these sediments. As noted above, the new outfall was designed to prevent flocculation and to take advantage of the natural off-shore currents within Commencement Bay.

To understand the remedial construction activities, it is necessary to understand the fishery "windows" in Puget Sound. Because of fishery and habitat concerns, federal, state, and local agencies and Indian Tribes place strict limitations on work in the waters of Puget Sound and the Puyallup River. Work in the waters of Commencement Bay is generally prohibited between mid-March and mid-June and between mid-October and mid-December each year (in other words, the fishery "windows" open and allow work only between December-March and June-October each year). In addition, work in the Puyallup River itself is generally prohibited, except for a portion of the summer months. Construction activities, including dredging, must stop when the fishery windows close - even if work is incomplete. These restrictions require careful staging and management of projects dealing with contaminated sediments.

In-water work began on December 16, 1987, after receipt of the 404/Section X permit from the Corps of Engineers. By March 17, 1988, when the fishery window closed, the new, extended outfall and diffuser was fully operational under Ecology's NPDES permit. Baseline monitoring for the new outfall and diffuser was also performed. The old discharge structure was removed and the old outfall line was sealed. The materials dredged for the placement of the new outfall and removed from in front of the chip unloading dock were deposited in depressions in the area of contaminated sediments and covered with an interim cap of clean material from the Steilacoom quarry. The one-foot depth of the temporary cover was verified by monitoring.

Construction activities for the overall project occurred on or ahead of schedule and met or performed better than required. One unexpected event is described below because it may be instructive in managing future sediment remedial actions. A mechanical problem that occurred during the dredging of the trench required to bury the shallow portion of the outfall pipe. On December 23, 1987, a barge containing dredged material was moored within the project area, waiting to be moved into position for discharge with the proper slack tide conditions. That evening, a hydraulic problem on the barge caused the bottom of the barge to open 24 inches wide, discharging approximately 700 cubic yards of dredged material. In accordance with the contingency plan, emergency meetings were held among the agencies, Simpson, and its consultants and contractors to assess the situation.

The material had been dredged from a portion of the outfall alignment which previous sampling indicated would not be contaminated. Nonetheless, the dredged material remaining in the barge and the material on the Bay bottom were both sampled and visually inspected for any release of contaminants, including personal underwater inspection by divers including Simpson's Project Manager Jerry Ficklin and principal remedial design consultant Don Weitkamp of Parametrix, Inc. Although problems appeared unlikely, Ecology and Simpson directed the dredging contractor to remove the material and place it in the area to be capped in accordance with the remedial design and engineering plans. The corrective actions were completed by December 31, 1987, and Ecology sent Simpson a letter of commendation for its prompt response. At a meeting on March 31, 1988 to assess the effectiveness of the remedial construction and monitoring techniques, the agencies and Simpson recommended that any hydraulic barges used for transporting contaminated sediments should be positioned over the precise disposal site if possible during temporary moorage.

Site preparation for the sediment and habitat components was also complete by March 17, 1988. Site preparation actions reflected the integration of pollution control and natural resource objectives in the remedial construction activities. Old pilings and large pieces of debris in the contaminated sediments were removed in order to prevent them from providing pathways for upward migration of toxicants. Their removal was also integral to using the Bay's natural forces to protect the physical integrity of the remedy and to reestablish habitat. Their removal, along with the outfall relocation, allowed restoration of natural tidal forces and accretion in the St. Paul Waterway area. By removing artificial seagull perching habitat which had been created by the old docks, there would be fewer seagulls serving as predators in the immediate area. This would help re-populate the new intertidal habitat by reducing the competition for food in the area, especially for young salmon.

Old above-water structures were removed and more than 1200 piles were pulled. The design required that all subsurface debris extending more than two feet above the sediment be removed. During this procedure, it was observed that sediment was being resuspended in the water column. In consultation with Ecology, both design and construction methods were altered to avoid disturbance of the sediments as logs and debris were mechanically pulled out of the areas of

greatest contamination. Construction methods were altered by using diver inspections to identify those logs and debris that were sufficiently exposed to warrant their removal to ensure cap integrity. The design was revised by leaving in place logs where less than three feet protruded from the sediment and by increasing the minimum thickness of the cap to eight feet in that area to provide an additional margin of safety. As noted below, post-construction monitoring confirmed compliance and cap thickness of between 12 and 20 feet in these areas. Other areas were prepared by a combination of mechanical methods and visual survey by divers. (Progress Report #3, dated March 17, 1988.)

Water quality data was submitted to Ecology in April 1988 for the period between December 1987 and March 1988 in a report entitled "Simpson Dredging and Disposal Monitoring Report". This report described the monitoring undertaken to evaluate the effects of dredging and disposal activities. Monitoring included sampling 150 feet down-current from each dredge site, and sampling at 150 feet, 300 feet and 600 feet from each disposal site. Additional water column samples were collected at the request of Ecology. Water quality remained within the state standards for Class B marine waters as measured for dissolved oxygen, percent light transmittance/turbidity, total suspended solids, pH, and hydrogen sulfide (Appendices A-D of the report provide the monitoring data). This report demonstrated that appropriate methods were used to control the disbursement of sediments during dredging and deposition.

C. Sediment and Habitat Capping and Completion

Because of fish migration in the Puyallup River, no in-water construction took place between March 15 and June 15, 1988. The final construction phase to place clean Puyallup River sediments over the contaminated area began as soon as the fishery window opened on June 16, 1988. Construction of the cap was finished on August 9, 1988. Under the state consent decree, most of Area A (see Figures 2 and 4) was to receive a cap of at least four feet of Puyallup River sediment, plus four-to-eight feet for habitat enhancement, with the most contaminated area to be filled above the high tide line. Contractor specifications required at least eight feet across Area A. Much of the area received 12 feet or more of cap, with areas up to 20 feet thick. Area B, which was to have at least five feet of river sediments, received a cap up to 12 feet thick. Area C, which was covered with woodchips but did not contain chemical contamination requiring isolation of sediments from marine life, was to receive a cap of two feet in order to provide a new Bay bottom; it received up to four feet of clean material. The Bay bottom in the project area before and after construction is shown in Figures 5 and 6. Cobbles and boulders were placed in the intertidal area as part of the habitat enhancement.

The cap was placed with a downpipe diffuser, attached to a pipeline which carried the clean sediments from the Puyallup River bed. The diffuser reduced the discharge velocity, reducing turbidity and improving the control for placing the sediments. Capping the contaminated sediments involved several steps, illustrated on Figure 4. The cap was generally placed in a series of 2-foot layers, or "lifts," to minimize turbidity, resuspension of sediments, sloughing and erosion. Prior to placing the first lift over the area, a crescent-shaped mound or berm of clean sediments was placed along the southwest boundary of Area A as a preventive measure to contain the contaminated sediments in Area A when the first lift was placed there (this concern did not materialize when the first lift was subsequently placed). This mound simply became part of the overall cap as the lifts were placed and the elevation of the cap rose.

As in the earlier phase, baseline or pre-construction monitoring and construction monitoring were conducted to assure quantity and location of the dredged and deposited materials, uniform coverage, adequate cap thickness, and water quality compliance. Water quality parameters were all well within standards (Progress Report #7, dated July 18, 1988). Core analyses taken from three locations after placement of the first two feet of cap in the most contaminated area gave nondetectable results for all parameters (Progress Report #8, dated August 11, 1988). The final report provided a ten sheet bathymetry analysis detailing the bottom contours of the Problem Area and the Puyallup River pre- and post-capping, and cross sections detailing the cover placement (Progress Report #9, dated September 13, 1988; see Figures 5 and 6 of this Completion Report). By letter on September 21, 1988, Ecology issued its letter of completion and acceptance of remedial construction activities in compliance with the terms of the state consent decree.

Key references for Part III: Progress Reports, including Construction Monitoring, in Part J of the bibliography, principal agency correspondence in 1988 in Part E of the bibliography, and before and after photographs in Part I of the bibliography.

IV. FEDERAL SUPERFUND PROJECT APPROVAL

A. Background on the Federal Superfund Process in Commencement Bay

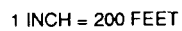
In October 1981, Commencement Bay was listed as the top priority for action in Washington state on an interim priority list developed by the EPA. Commencement Bay was divided into four areas: Deepwater, Nearshore, Tideflats Industrial, and South Tacoma Channel. On December 30, 1982, the Nearshore and Tideflats Industrial Areas were designated as a discrete project. In early 1983, the EPA and Ecology announced that Ecology would conduct a Remedial Investigation and Feasibility Study (RI/FS) of the contamination in the Nearshore/Tideflats area of Commencement Bay. The RI was initiated in 1984, and the results were published in 1985. The RI concluded that sediments within the study area contained elevated concentrations of metals and organic compounds.

Beginning in 1986, additional field sampling was conducted for the initial phase of the FS. The purpose of the FS was to develop and evaluate the most appropriate remedial strategies for correcting hazards associated with contaminated sediments in the CB/NT Site. The FS was published in December 1988 and identified nine problem areas that were recommended for further action under the federal Superfund program. The FS concluded that correction of contamination problems should take place over a period of several years by several regulatory authorities using a wide variety of existing regulations and implemented according to a performance-based Record of Decision (ROD).

A proposed plan, based on the RI/FS was published for review and comment from February 24 to June 24, 1989. Based on consideration of public comment, EPA selected the remedy for the CB/NT site with the concurrence of Ecology and the Puyallup Tribe of Indians. The ROD was published on September 30, 1989. It addressed eight of the nine problem areas described in the FS, the ASARCO sediments problem area was deferred to a separate operable unit.



Figure 5.



SIMPSON TACOMA KRAFT MILL
POST CAP SURVEY
(AUGUST, 1988)

Source: Parametrix, Inc.

The ROD determined that the most appropriate remedy for achieving the CB/NT cleanup objectives was a combination of Source Control/Natural Recovery and Sediment Confinement. The key elements of the selected remedy for the overall CB/NT Site include the following major elements:

- Site use restrictions
- Source control
- Natural recovery
- Sediment remedial action
- Monitoring

In general, the selected remedy includes the appropriate combination of these elements and is implemented in each of the different problem areas independently of one another. The overall remedy includes an 8-year active cleanup phase for source control and sediment remediation and a 10-year natural recovery phase.

Implementation of source control, the first step in the selected remedy, includes application of regulatory mechanisms and remedial technologies including a full range of all known available and reasonable methods of treatment (AKART) to achieve compliance with applicable or relevant and appropriate requirements (ARARs) and to maintain the sediment quality objectives defined in the ROD. Ecology is the lead management agency for source control under a cooperative agreement with EPA. As explained in Section I.C above, EPA has approved Ecology's Source Control Completion Report for the St. Paul Waterway Problem Area.

EPA is the lead for sediment remedial action. Under the ROD, each response action will involve one of four options for confinement of contaminated sediments. Sediment cleanup is to achieve acceptable sediment quality in a reasonable time frame. The objectives are defined in terms of biological and chemical tests, using tests developed by the Puget Sound Estuary program. The cleanup objectives identified by the ROD were developed with reference to the 1989 Puget Sound Water Quality Management Plan (PSWQA 1988) and stated the sediment quality goal as "the absence of acute or chronic adverse effects on biological resources or significant human health risk." The attainment of that goal is measured by monitoring for biological effect levels or chemical concentrations.⁵ Habitat function and enhancement of fisheries will also be incorporated into cleanup objectives.

⁵The values set for apparent effect thresholds (AETs) were developed for Puget Sound sediments and used in the planning and approval of this remedial action. See, for example, CB/NT RI (1985); CB/NT FS (1989); CB/NT FS, Development of Sediment Criteria (1986, 1987) and the primary document, Development of Sediment Cleanup Goals (1989); Development of Sediment Quality Values for Puget Sound. Report to Puget Sound Disposal Analysis and Puget Sound Estuary Program. U.S. Environmental Protection Agency, Region X, Seattle, WA (Volume 1, 1986).

**B. Completion of the Federal Approvals for the
St. Paul Waterway Problem Area**

Because the CB/NT FS was delayed (it was rescheduled for completion in June 1988), it was not possible to have simultaneous federal and state Superfund approval of the project, as described in the preceding sections of this report. EPA sent a letter to Simpson on December 9, 1987, advising that it could not formally approve or authorize the project because of this delay in the overall Commencement Bay Nearshore/Tideflats study process. EPA encouraged Simpson, Champion and Ecology to move ahead expeditiously, however, noting the coordination between the project planning and the CB/NT RI/FS process. The letter stated:

We understand that Simpson has coordinated its plans and analysis for this project closely with TetraTech, Inc., which is using Superfund monies as the Washington State Department of Ecology's (Ecology) consultant for the performance of the Commencement Bay Nearshore/Tideflats Superfund Remedial Investigation and Feasibility Study. Although the analysis which Simpson has prepared for the project does not appear to be inconsistent with the overall Commencement Bay Feasibility Study thus far, EPA cannot formally approve or authorize your project until the Superfund process is complete.

As noted above, the CB/NT FS was issued in February 1989, and EPA issued the CB/NT ROD on September 30, 1989. The FS and ROD analyzed the documentation and actions taken at the St. Paul Waterway Area to date, including source control and monitoring, and selected capping in place (*in situ* capping) as the preferred alternative. The ROD indicated that revisions in the monitoring plan were necessary to assure the effectiveness of the remedy. EPA began meeting with the federal and non-federal natural resource trustees to review the actions taken to date, including the monitoring data, and to develop proposed revisions in the monitoring plan.

In May 18, 1990, EPA sent a special notice letter under CERCLA Section 122(e) to Simpson, Champion, and DNR inviting negotiations with EPA and the trustees on a proposed federal consent decree, including reimbursement of agency costs and a revised monitoring plan, and on natural resource damage claims. Following negotiations, a federal consent decree was signed by the parties on September 27, 1990, and transmitted to the U.S. Department of Justice. The federal consent decree included a modified monitoring plan, reimbursement of costs, and a natural resource damages settlement. The performance standards and monitoring in the federal consent decree are summarized in Part VII below. The consent decree also required filing and EPA approval of this completion report. The parties agreed to an amendment to the state consent decree to assure consistency.

Formal public comment will also be sought on the federal consent decree. To assist public review, joint notice and comment will be taken on all aspects of the action, including the federal consent decree and its attachments, such as the monitoring plan, completion report, and natural resources settlement documents, and the state consent decree amendment.

Key references for Part IV: CB/NT ROD, Integrated Action Plan and other supporting documents, Ecology Source Control Completion Report, principal agency correspondence in 1989-90 in Part E of the bibliography.

V. POST-CONSTRUCTION MONITORING RESULTS

A. Introduction

The initial post-construction monitoring to assure that physical parameters were met is described in the preceding section. The bathymetry data showed that the addition of approximately 236,000 cubic yards of clean sediment to isolate the contaminated sediments and create healthy habitat resulted in a cap that was thicker than required and met the physical performance standards (Figures 5 and 6; see intertidal cross-section on Fig. 6). The planning documents noted that reshaping of the new Bay bottom would occur because of the amount of fine sediment added to the area and the restoration of natural currents when the old outfall and pilings were removed.

As noted above, the Monitoring and Contingency Plan, which was part of the state consent decree and other approvals, required ongoing monitoring to assure the effectiveness of the remedy. The monitoring included physical, chemical, and biological monitoring. It also established an "early warning" system to anticipate potential problems, and a contingency planning and response process if the sediment and habitat actions did not perform as planned. The plan provided for modifying long-term monitoring requirements based on the results received, including providing for less intensive analysis if monitoring demonstrated continued effectiveness.

In addition to early warning reports, the plan required an annual report on the results of the previous year's monitoring. A draft of the second annual post-construction long-term monitoring report was submitted for agency review in January 1990. The final report, entitled "St. Paul Waterway Area Remedial Action and Habitat Restoration Project Monitoring Report 1988-1989" (Monitoring Report) was issued in June 1990. This report described physical, chemical and biological monitoring in October-November 1988 and in June-August 1989. An additional analysis, entitled "Gas Monitoring Report, St. Paul Waterway Remedial Action and Habitat Restoration Project" (Gas Monitoring Report) was submitted in draft form in February 1990.

The monitoring was conducted by Parametrix, Inc., consultants for Simpson and Champion, in accordance with the methods and procedures in the Monitoring and Contingency Plan adopted in 1987, approval of specific annual monitoring programs by Ecology in coordination with the consulted agencies, and on-site agency oversight and inspection of the monitoring activities. In addition, interested members of the public have been regularly invited to inspect the site and discuss the results of the monitoring. Confirmational monitoring will continue under the revised Monitoring Plan included in the federal consent decree.

B. Physical Monitoring

Monitoring and inspection during construction assured that the cap thickness met or exceeded the remedial action design specifications. The construction monitoring data included in the final monthly progress report serve as the baseline for subsequent monitoring (Figure 6). Post-construction monitoring was conducted to determine the cap's stability and sedimentation rates over a period of about ten months. Cap monitoring consisted of measuring the cap elevation relative to mean lower low water (MLLW) at various intertidal and subtidal locations. A statistically significant decrease in overall cap elevation would indicate that forces such as erosion or wave

action were reducing the cap thickness. Similarly, a net increase in cap elevation would indicate that additional Puyallup River sediment was being added to the cap, as anticipated by the design.

Measurements of cap elevation were taken during five surveys conducted between December 7, 1988 and June 8, 1989, using a standard theodolite with an electronic distance measuring device (EDM). Each survey consisted of measuring elevations along five transects perpendicular to the shoreline (Monitoring Report, Section 2). The data showed no elevation change that appeared to threaten either the new habitat or the cap integrity. The intertidal portion of the cap showed some elevation changes that were anticipated due to settling and wave action. Increases in elevation observed closest to the mouth of the river were also anticipated by the design of the cap. There was no indication of a loss of cap material. The cap thickness remains in excess of the consent decree requirements. Although performance standards are currently met, detailed bathymetry and aerial photography will continue as part of the confirmational monitoring under the revised Monitoring and Contingency Plan included in the federal consent decree.

Because of concern that dredging of the clean sediments from the Puyallup River might leave a depression that could cause an adverse effect on fish, bathymetric surveys were also conducted in the Puyallup River dredge area (borrow area) to determine how fast it was filling in after completion of dredging operations. Bathymetry data showed that the borrow area has essentially returned to pre-dredge conditions, with profiles somewhat flatter than the pre-dredge profiles. No further monitoring is needed.

C. Chemical Monitoring

Chemical monitoring has two main purposes: (1) to serve as an "early warning" if unexpected conditions develop; and (2) to measure performance until biological performance standards are developed. Performance is measured by results from samples that do not have values higher than the lowest apparent effects threshold (LAET).⁶ The early warning role is achieved by monitoring chemicals of concern and triggering the contingency planning process if a sample shows 80% of the LAET for an indicator group of chemicals. As the Monitoring Plan and Monitoring Report explain, an early warning level does not mean that the cap is not working. The approach is intended to verify at the earliest possible time whether a problem really exists and to anticipate the need for response planning before a serious problem might occur.

Sediment cores were collected in November 1988 and September 1989 at five stations, with three replicate cores collected at two of the stations. Metals and organics were analyzed according to the methods and quality control procedures identified by EPA's Contract Laboratory Program (EPA-CLP). Conventional pollutants were analyzed according to methods identified by the Puget Sound Estuary Program protocols (PSEP).

The chemical monitoring performed currently indicates no measurable chemical migration through the cap. All chemical concentrations in the cap are far below the 80% LAET level specified in the Consent Decree. Analysis of sediment samples showed that organic chemical concentrations

⁶The applicable LAET is based on the amphipod, oyster, or benthic AET, whichever is lowest for each chemical. The chemicals and AET values are listed on tables included in the Monitoring Plan. AETs were developed for Puget Sound sediment criteria. See footnote 5.

were generally below analytical detection limits for all organic chemicals at most stations. Organic and metal concentrations in the cap sediment were generally in the same range as those measured in the Puyallup River sediment before using it as cap material.

In 1988, some slightly elevated concentrations well below LAETs were observed in the top and bottom samples from Station C2 with completely clean materials in between. Because this station is near the edge of the cap formed during the first stage of capping, Parametrix and the Companies have concluded that a small quantity of material from the adjacent uncapped area may have mixed with surface material during placement of the second round of capping sediments. Although early warning levels were not exceeded, additional contingency monitoring was conducted in 1989. Three cores were taken at Station C2, but fewer samples showed similar concentrations and none were detected at any of the surface samples. Chemical analysis to date demonstrates that the contaminated sediments are isolated from the Commencement Bay environment (Monitoring Report, Section 3). Although performance standards are currently met, detailed chemical analysis of the cap will continue with some additional areas of analysis as part of the confirmational monitoring under the revised Monitoring and Contingency Plan included in the federal consent decree.

D. Biological Monitoring

A major objective of the project was to restore subtidal habitat and enhance intertidal habitat. Biological analysis of the cap area included a detailed description of the physical environment in the cap and its effect on the organisms inhabiting it, and an examination of the distribution of the organisms found in the cap area. Existing biota was compared with that occurring at two reference sites in order to distinguish between changes that are a part of the development of the cap community and changes resulting from general environmental conditions in Commencement Bay. The long term monitoring activities under the federal consent decree include reviewing these reference areas and locating additional reference areas if possible.

Benthos are organisms that live in or on the bottom of a body of water. Benthos samples were collected in June 1989 from four cap stations and two reference sampling stations. Five replicate samples were obtained at each station and an additional grab was taken to provide a sample for sediment particle size distribution and chemical analysis. Surveyors onshore verified sampling sites and positioning was monitored during all sampling.

The data collected demonstrate that a moderately complex community of polychaetes, mollusks, and crustaceans now lives in the new benthic habitat. This community appears to be a combination of some of the most common and most opportunistic species present in Commencement Bay. About 100 different species were observed with substantial differences in species composition at different sites. As described above, the goal of the habitat design was to produce a variety of conditions by varying contours, producing tidal pools, and adding rock substrate, which has now occurred in the area.

Epibenthos are organisms such as crustacea that live between low water and shallow subtidal areas in Puget Sound and are important food source for fish, such as juvenile salmonids. Epibenthos were sampled to see how successfully the newly created intertidal habitat provided a return to more natural conditions. A reference site at the mouth of the Puyallup River was sampled in 1988 before construction of the new habitat. In 1989, epibenthos were sampled at six stations on the newly created intertidal area and at two depths at the Puyallup River reference station. In general,

the cap stations had a greater abundance and greater diversity of epibenthic organisms than either of the two reference stations. Analysis of the data shows a high degree of dissimilarity among all stations. The intertidal habitat has been populated by four species of marine macrophytes (large attached algae) which covered most of the hard substrate available by the summer of 1989 (Monitoring Report, Sections 4, 5, and 6).

Recognizing the area is in a dynamic state, to date the constructed habitat is achieving the objective of providing varied habitat types for epibenthic organisms, including juvenile salmonid prey species. The newly restored and enhanced habitat is still developing, and the success of the habitat will be more fully assessed when the area has a more established biological community. Biological monitoring will continue with the addition of reference station analysis and benthic analysis as part of the confirmational monitoring under the revised Monitoring and Contingency Plan included in the federal consent decree.

E. Contingency Monitoring Including Gas Monitoring

As anticipated by the *Project Analysis*, gas has been released at discrete locations through the cap sediments. This gas is produced as a result of the decomposition of the large quantities of organic materials in the original sediments now covered by the cap. Because of the observations of gas, contingency monitoring was conducted under the Consent Decree's Monitoring and Contingency Plan at the request of the regulatory agencies, including EPA, NOAA, and Ecology, to determine whether the gases were providing a transport mechanism for chemicals from the contaminated sediments isolated beneath the cap.

Gas and surface sediment samples were collected from three stations on the cap and one reference station in September 1989. Chemical analyses showed that the gases are the products of organic decomposition, consisting primarily of methane and carbon dioxide, in concentrations similar to those observed in other marine sediments in the reference area and reported in the literature. There were no measurable quantities of the chemicals the cap was constructed to isolate. Chemical concentrations in the sediment at the vents were equal to or less than LAETs.

Although standards have been met with the completion of the remedial construction activities, long-term monitoring for potential exposure pathways, including gas vents, will continue as needed as part of the confirmational monitoring under the revised Monitoring and Contingency Plan included in the federal consent decree.

F. Quality Assurance/Quality Control

Although the remedial action was carried out pursuant to a state consent decree to which EPA was not a party, all procedures and protocols were selected in order to comply with EPA and Corps of Engineers quality assurance/quality control requirements. Procedures and protocol followed for monitoring during construction are specified in the Monitoring and Contingency Plan in the state consent decree and in the monthly progress reports. Procedures and protocols followed during post-construction monitoring are specified in the Monitoring Report and Gas Monitoring Report. Procedures and protocols for long-term confirmational monitoring are specified in the revised Monitoring and Contingency Plan in the federal consent decree, which supersedes the

various permits and permit conditions for the project. The state consent decree will also be amended to include the revised plan. Additional post-construction monitoring is described in the next two parts of this report.

Key references for Part V: State Consent Decree including Monitoring Plan, Progress Reports, including Construction Monitoring, in Part J of the bibliography, principal agency correspondence in 1989-90 in Part E of the bibliography, before and after photographs in Part I of the bibliography, confirmational monitoring reports and references cited therein in Part K of the bibliography.

VI. SUMMARY OF OPERATION AND MAINTENANCE

While the actions previously implemented in the St. Paul Waterway Problem Area under the state consent decree implemented and largely accomplished EPA's selected remedy for the cleanup of contaminated sediments in the St. Paul Waterway Problem Area as determined in the CB/NT ROD, revisions in the Monitoring Plan were necessary to ensure consistency of the St. Paul Waterway action with EPA's ROD and with the settlement of natural resource damage claims. These revisions have been incorporated into the monitoring plan.

The St. Paul Waterway Problem Area is now in the long-term confirmational monitoring phase. Operation and maintenance will consist of implementing the revised long-term Monitoring, Reporting and Contingency Plan (Monitoring Plan), dated September 1990, which includes conducting and reporting on the annual monitoring program and, if needed, performing contingency planning or response. The objectives of this monitoring are described below in Part VII on "Protectiveness."

Long-term monitoring has been designed to ensure performance standards are met by detecting any loss of cap integrity and assessing if the natural habitat has been restored relative to reference areas. Physical, chemical, and biological monitoring will be conducted. Ground surveys of bathymetry and intertidal transects will provide the basic physical monitoring data. Benthos, epibenthos, and macrophytes will continue to be the subject of the biological monitoring. Surface and subsurface chemistry of the cap, as well as of gas vents and intertidal seeps, will be monitored, including analyzing samples for LPAH, HPAH, chlorinated benzenes, pesticides, phenols, volatile organics, resin acids, metals and miscellaneous extractables. Values have been established for AETs for each of the selected parameters. Eighty percent of the LAET will continue to be the "early warning" level triggering the need for a contingency planning. Performance standards must be met, as described below in Section VII.C. EPA is the lead agency for oversight of Monitoring Plan and for coordination of the contingency planning process for the sediment remedial action under the federal consent decree and amended state consent decree.

A separate monitoring effort under Ecology's NPDES permit will measure the effectiveness of source control and of the ability of the new outfall to discharge mill effluent without creating environmental contamination. This monitoring is described above in Section I.C and in the Source Control Completion Report.

Key references for Part VI: Federal and State Consent Decrees including Monitoring Plan, principal agency correspondence in 1990 in Part E of the bibliography, confirmational monitoring reports and references cited therein in Part K of the bibliography.

VII. PROTECTIVENESS

A. Summary of Monitoring Results to Date

The sediment quality goal identified in the Commencement Bay Nearshore/Tideflats Record of Decision is stated as "the absence of acute or chronic adverse effects on biological resources or significant human health risk." The ROD also identifies sediment quality objectives to be met in each problem area. The monitoring activities conducted thus far in the St. Paul Waterway Problem Area and summarized in Section V of this report on Post-Construction Monitoring Results confirm the absence of most contaminant parameters in detectable quantities and confirm that standards have been complied with to date. As of this report:

- All measurable contaminants were well below the "early warning" LAETs.
- The cap met and exceeded the thickness required by the design and its integrity has not been impaired by either erosion or diffusion of contaminants from below.
- Benthic and epibenthic communities re-emerged and species abundance and diversity has to date demonstrated "the absence of acute or chronic adverse effects on biological resources."

B. Summary of Long Term Monitoring

The remaining activity to be performed at this problem area is long term monitoring specified by the Monitoring Plan, which has been revised under the federal and state consent decrees. The goals of the sediment remedial action taken by Simpson and Champion are to ensure that:

- Toxic concentrations of previously identified chemicals of concern are isolated from marine biota.
- Cap sediments are not recontaminated with chemicals of concern from the underlying sediments or the mill.
- Contaminated sediments remain isolated for a sufficient period of time to allow the concentrations of chemicals of concern to decrease to an acceptable level (i.e., chemical and microbial activity modify chemical composition of buried sediments over time).
- The natural habitat has been restored to support a productive biological community comparable in species composition and abundance to other relatively noncontaminated estuarine habitats in urban areas.

The following processes will be monitored to assess cap integrity:

- Physical erosion to assure cap depth is sufficient to isolate marine organisms from contaminated sediments. Bathymetric and chemical monitoring can detect these changes.
- Physical mixing to assure that the cap and the underlying contaminated sediments are not being mixed and pose a threat to cap integrity. Chemical monitoring can detect this process.
- Upward diffusion to assure contaminants are not moving through the cap and pose a threat to cap integrity. Chemical monitoring can detect this type of change.
- Surface contamination to assure seeps and vents are not vehicles for recontamination.
- Surface contamination from other sources. For example, potential offsite contaminant sources could affect the remediation site and deposit chemicals of concern. Again, chemical monitoring can detect this process.

As previously noted, Ecology has responsibility for monitoring source control through the NPDES permit for the mill.

C. Summary of Performance Standards

In connection with evaluating long term monitoring data, the federal consent decree specifies performance standards for the sediment remedial action (paragraph 48).

There are three types of performance standards: physical, biological, and chemical.

- The physical standard consists of at least three feet of clean sediment in Areas A and B.
- The biological standard consists of not finding an adverse effects for: benthic infauna abundance (i.e., that mean abundance is less than 50 percent of the reference area); amphipod mortality (i.e., mortality exceeds 25 percent of the reference sample); and larval abnormality (i.e., mean abnormality exceeds 20 percent of the reference sample).
- The chemical standard, which is an interim standard to be used only until reference areas are approved for the biological standard, consists of using the lowest AET (except microtox) from the top two centimeters of the cap as an indicator.

These performance standards are designed to be used in conjunction with each other to evaluate the protectiveness of the remedy at the St. Paul Waterway Problem Area. The performance standards are based on sediment quality objectives in the ROD, specific human health risk assessments, environmental effects tests, and associated interpretative guidelines including the Puget Sound Estuary Program protocols.

D. Periodic Review and Other Requirements

In connection with evaluating long term monitoring data, both the federal and state consent decrees provide for "periodic reviews" at least every five years to verify that performance standards are being met and that the remedy is protective of human health and the environment.

In addition, the federal and state consent decrees contain other protections, such as requiring that: the entry of the consent decree be recorded in the County Auditor's office; EPA and Ecology be notified prior to any property transfers; and provision is made for continuing the obligations under the decree, including monitoring activities.

Key references for Part VII: Federal and State Consent Decrees including Monitoring Plan, principal agency correspondence in 1990 in Part E of the bibliography, confirmational monitoring reports and references cited therein in Part K of the bibliography.

A bibliography of all reports relevant to the completion of this problem area is attached. These documents are available by calling the EPA Region X Superfund Branch, 1200 Sixth Avenue, Seattle, Washington 98101, at (206) 442-2710 and asking for the Superfund Site Manager for the St. Paul Waterway Problem Area.